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(54) **DEPTH ADJUSTMENT FOR CONTROLLING PLANTING DEPTH**

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A01B 63/00	(2006.01)
A01B 63/16	(2006.01)

(52) **U.S. Cl.**

CPC ***A01B 63/26*** (2013.01); ***A01B 63/008*** (2013.01); ***A01B 63/166*** (2013.01); ***A01C 5/064*** (2013.01)

(58) **Field of Classification Search**

CPC A01B 33/087; A01B 63/166; A01B 36/20; A01B 49/04; A01C 7/203; A01C 5/00; A01C 5/06; A01C 7/18

See application file for complete search history.

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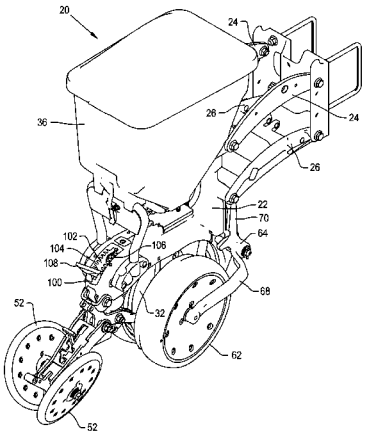
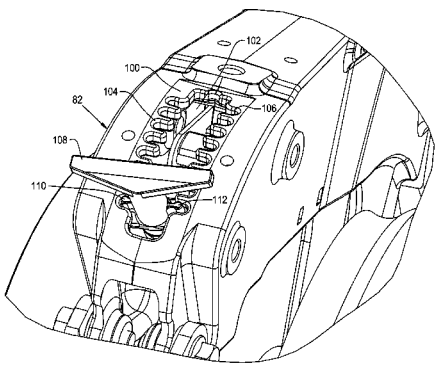
(57) **ABSTRACT**

A depth adjustment for an agricultural seed planting implement has a register with notches and a handle that engages pairs of the notches to control the depth of a seed trench opening assembly. The handle has a first handle orientation and a second handle orientation for each pair of notches and provides two different depth settings for each pair of notches in the register.

10 Claims, 8 Drawing Sheets





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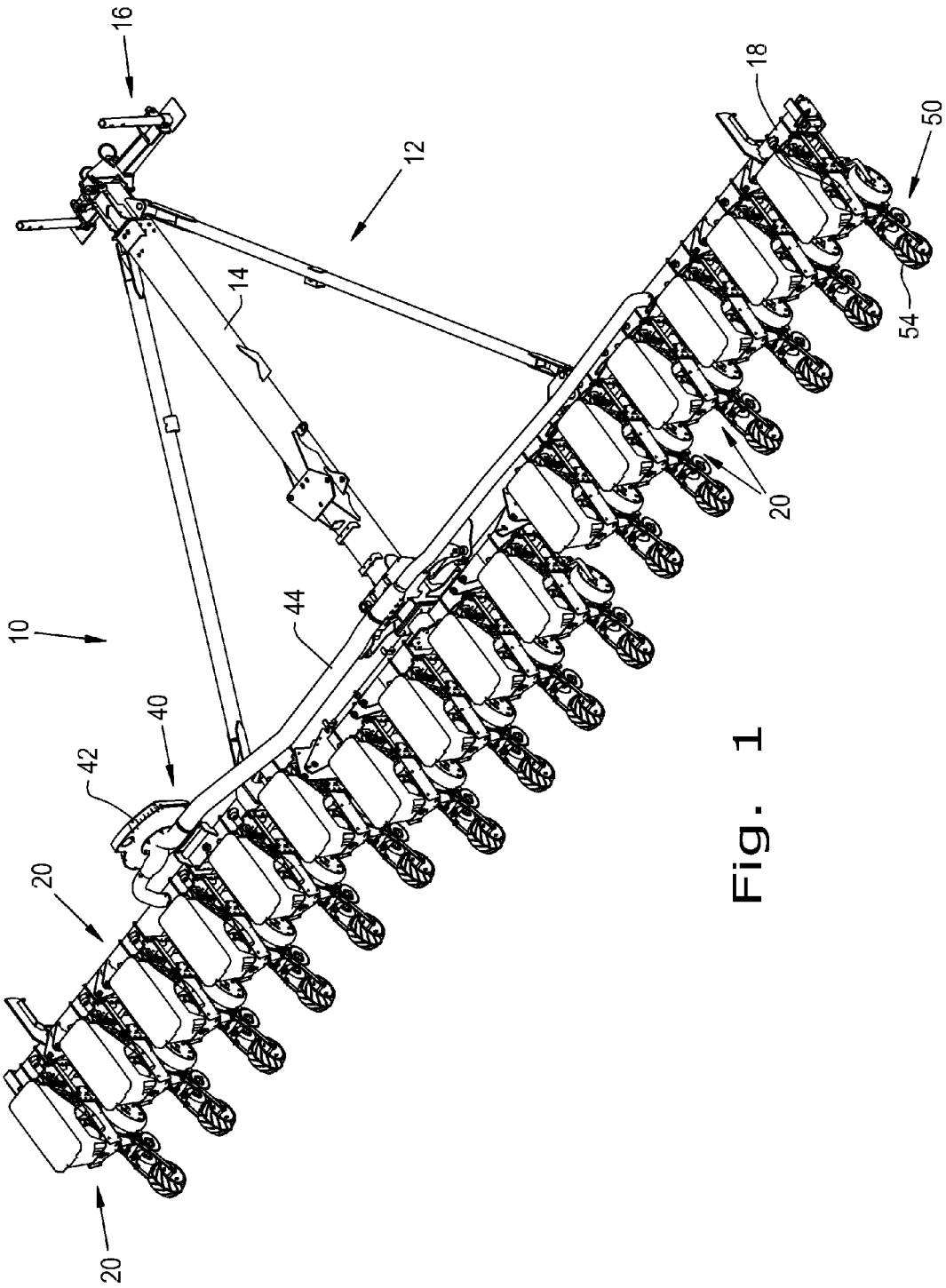

Fig. 1

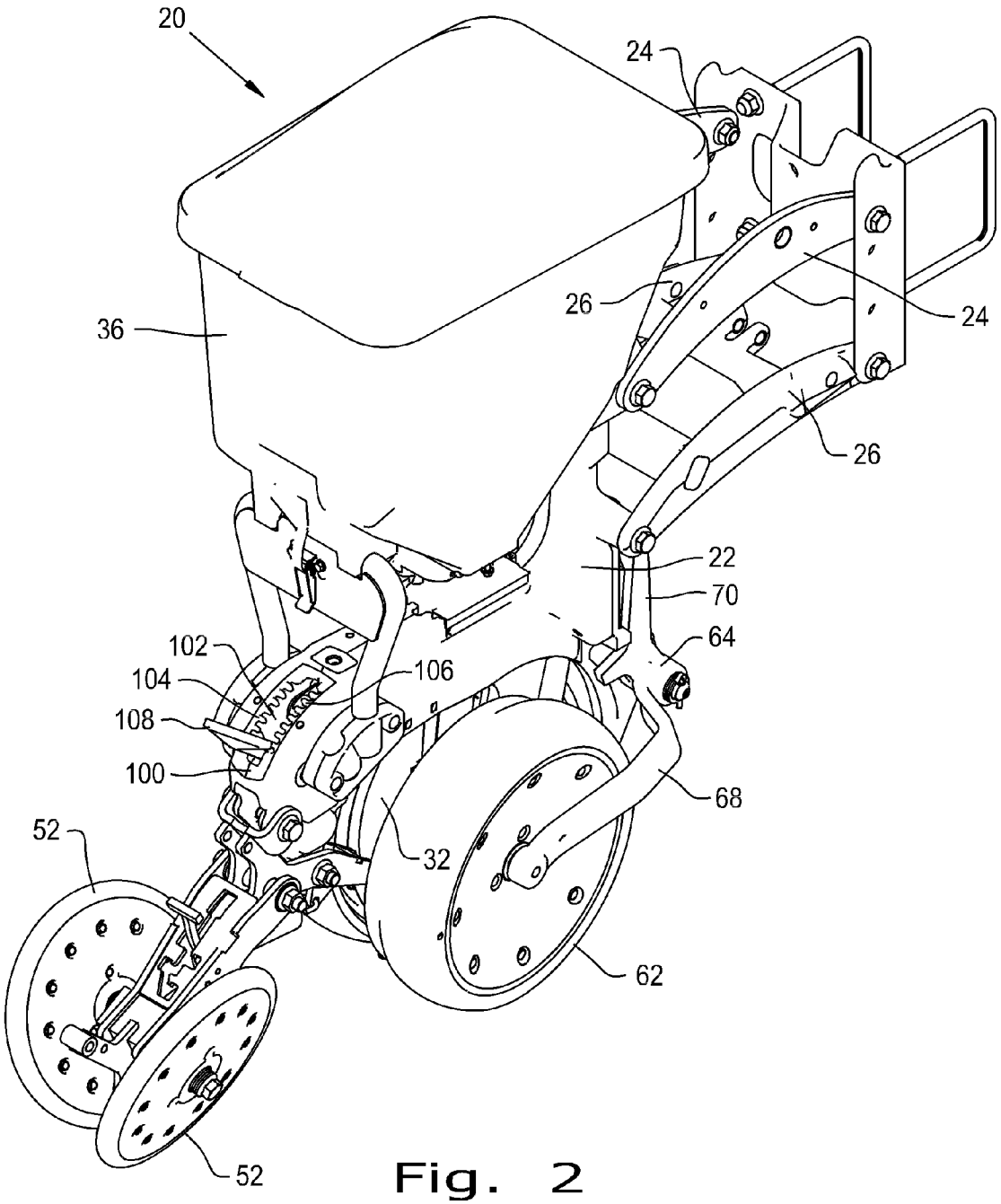

Fig. 2

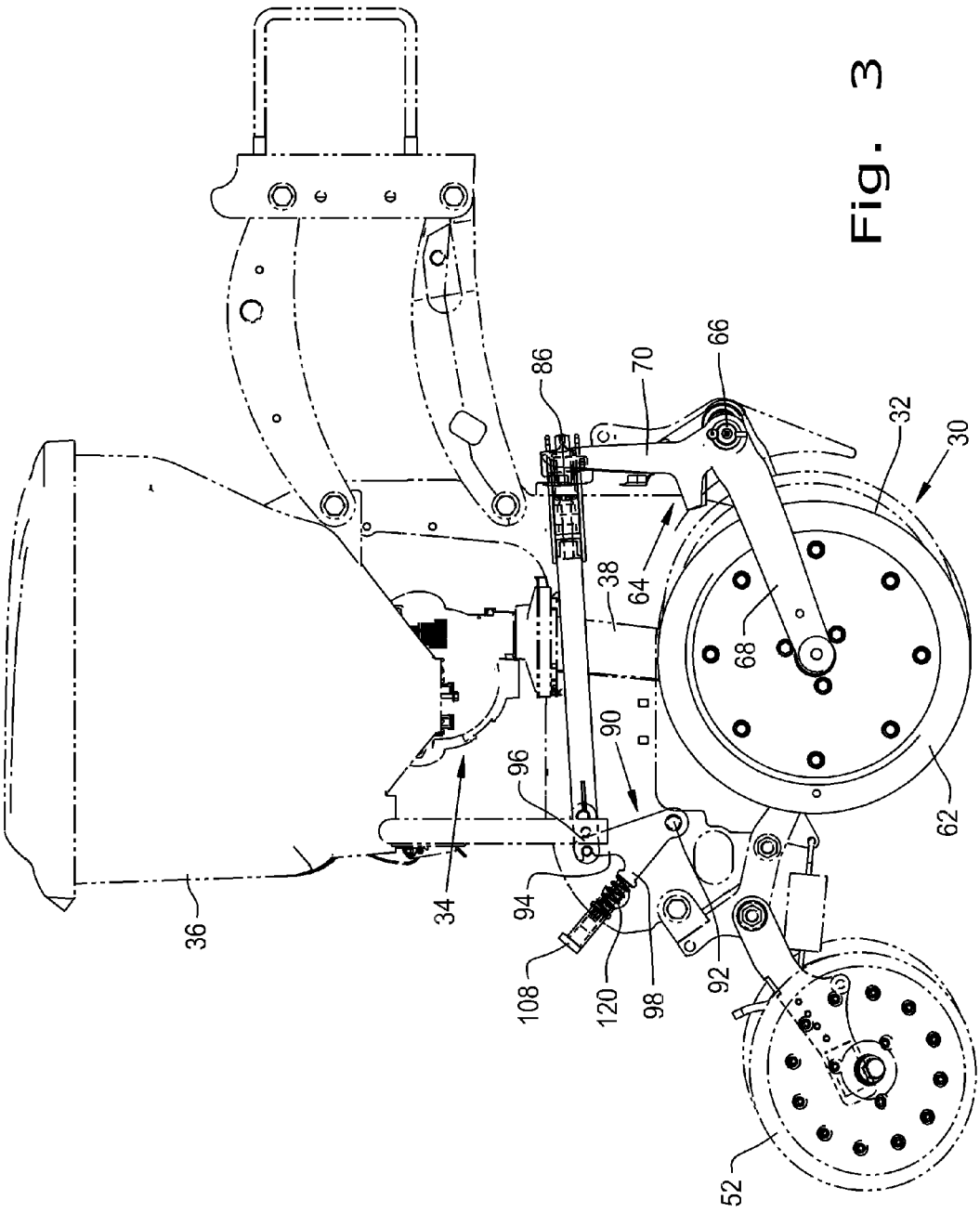

Fig. 3

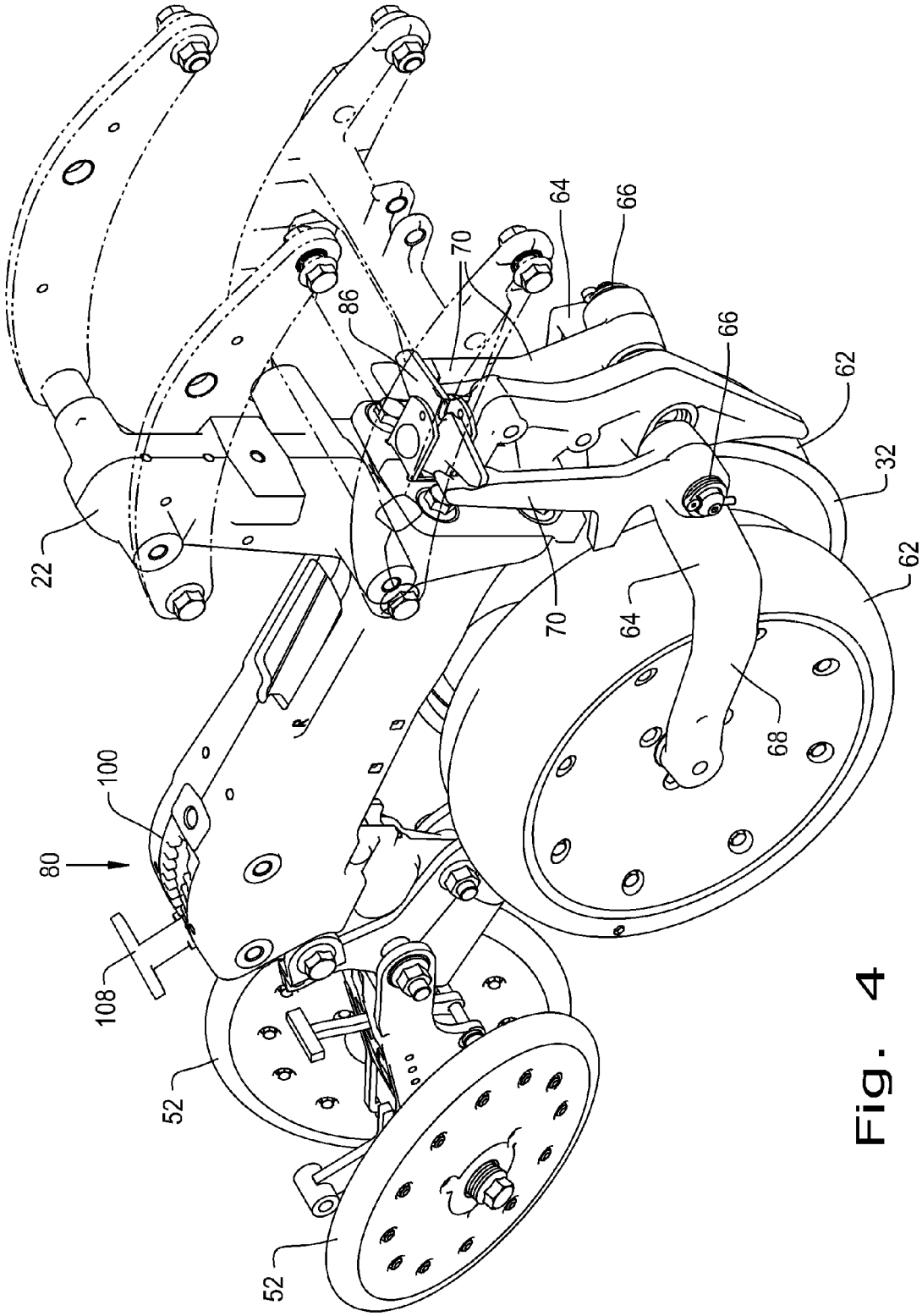

Fig. 4

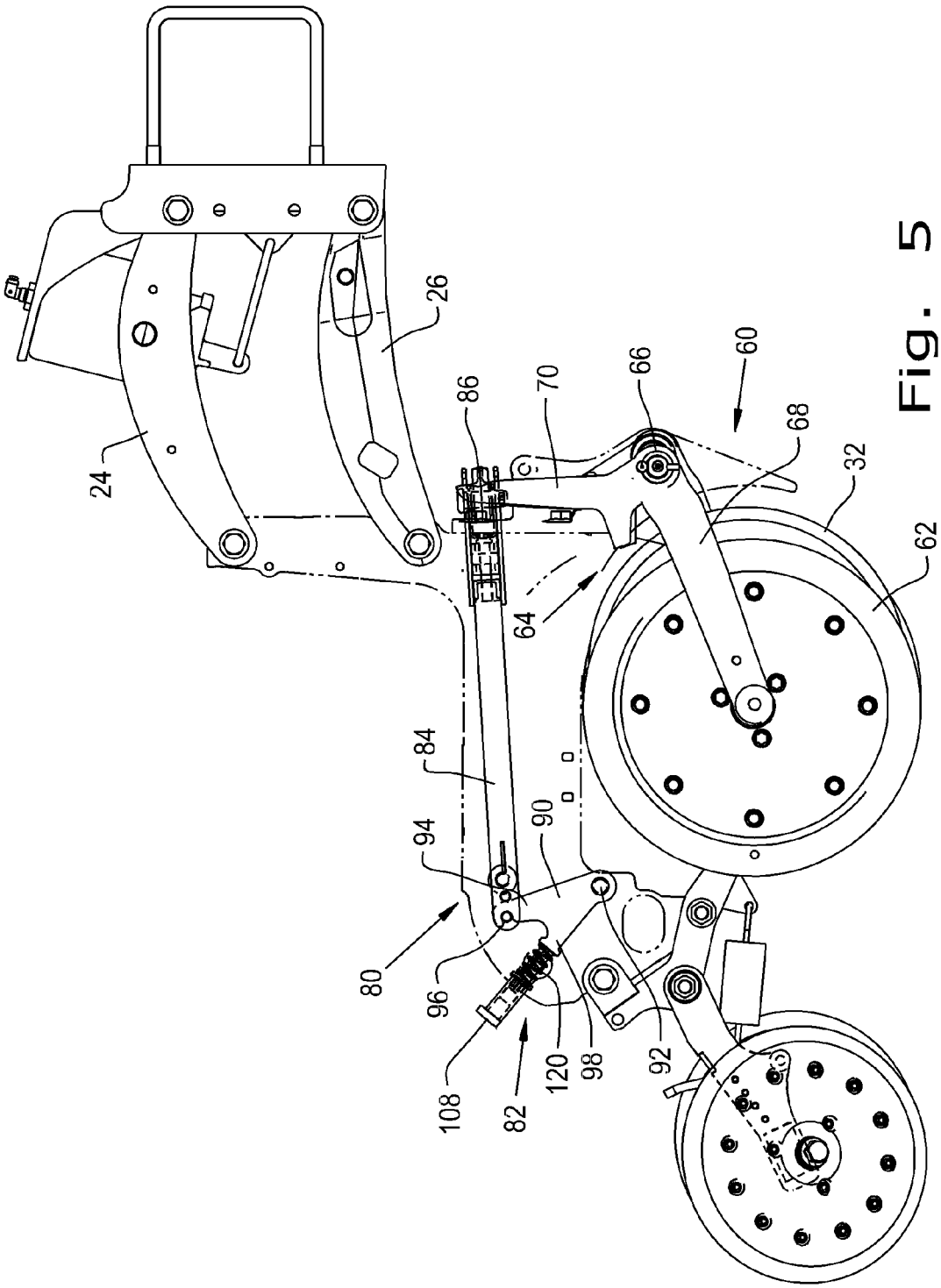

Fig. 5

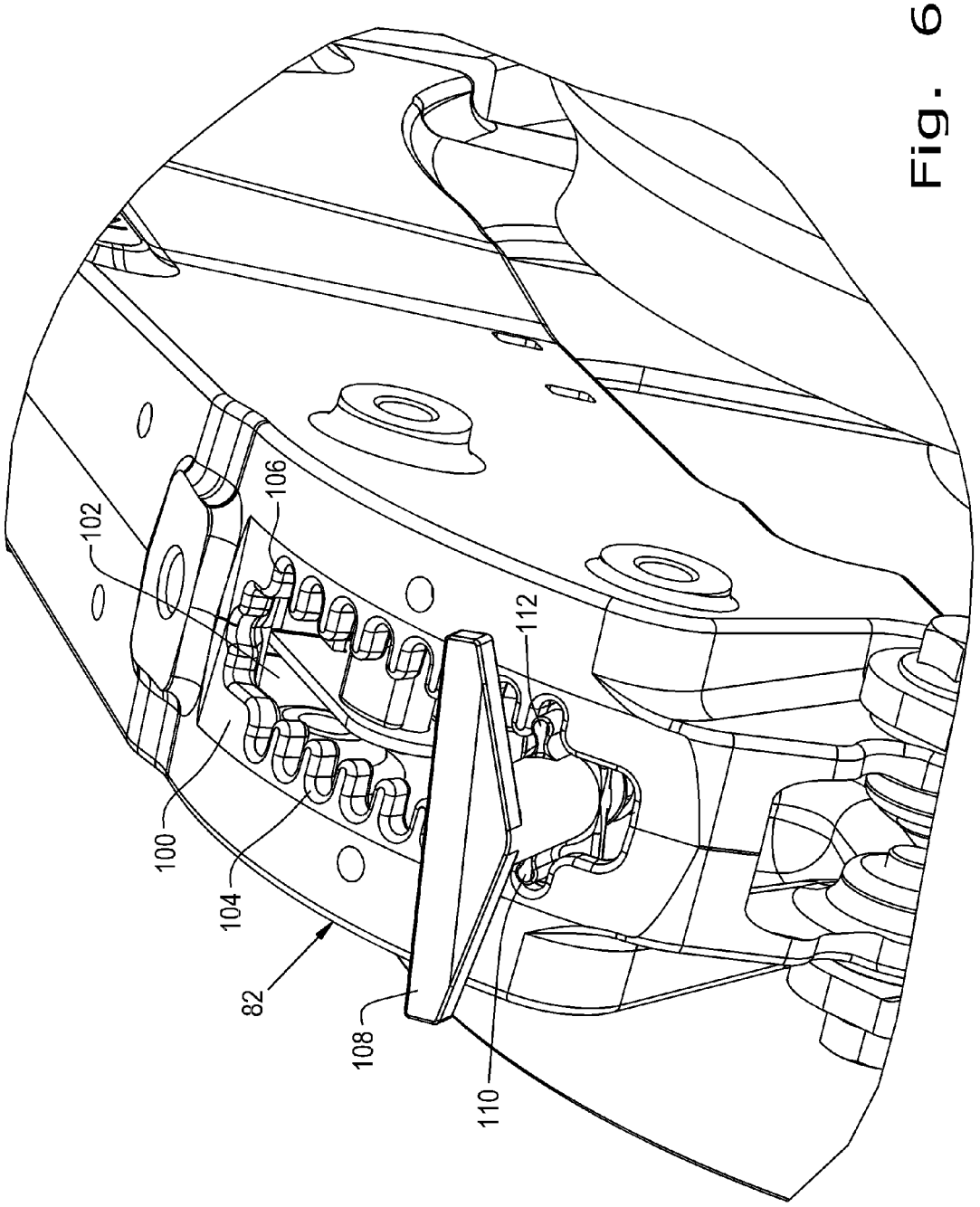

Fig. 6

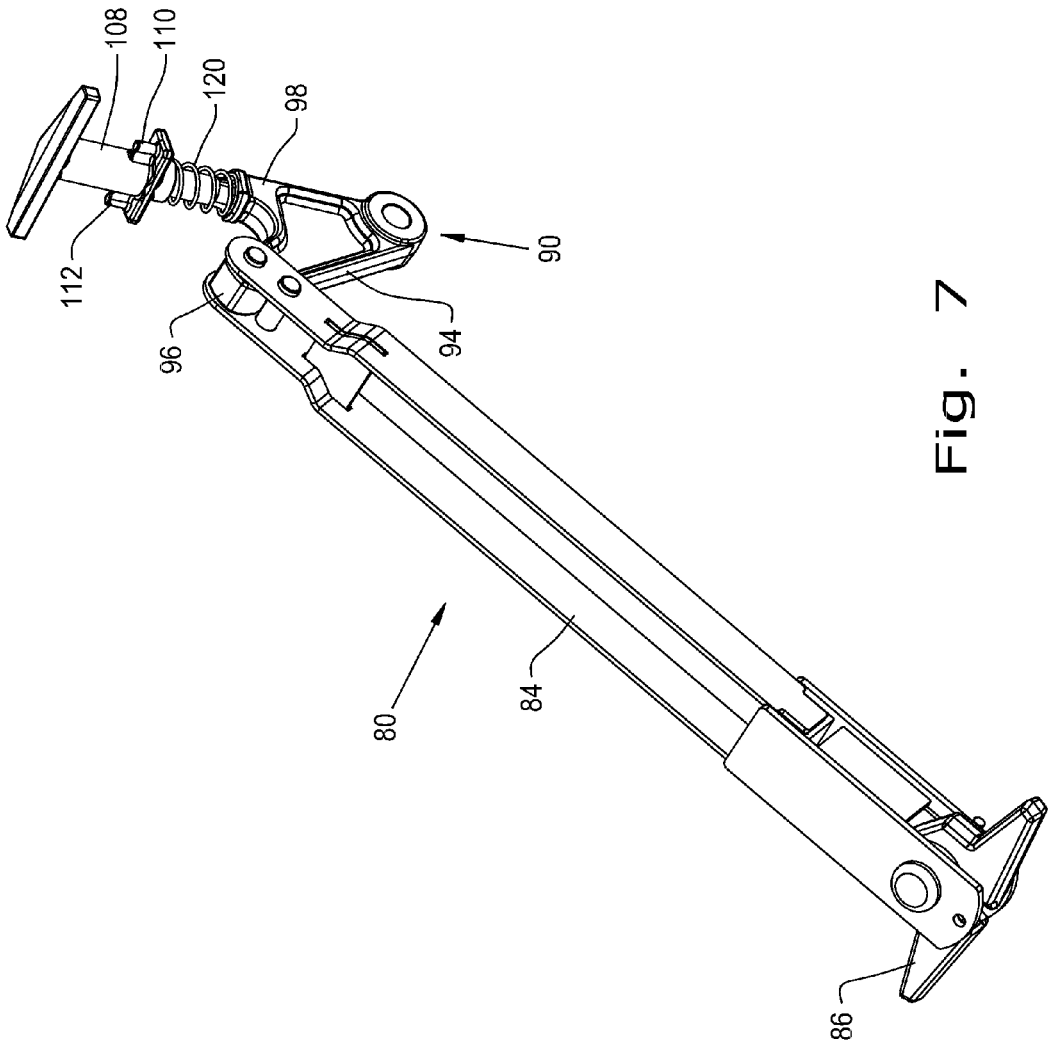

Fig. 7

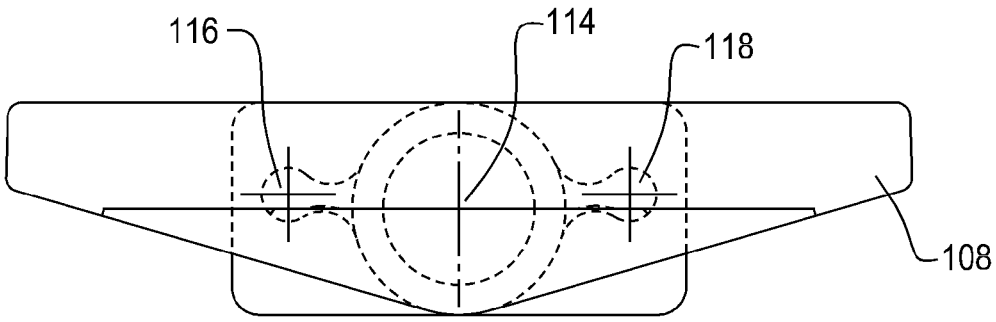

Fig. 8

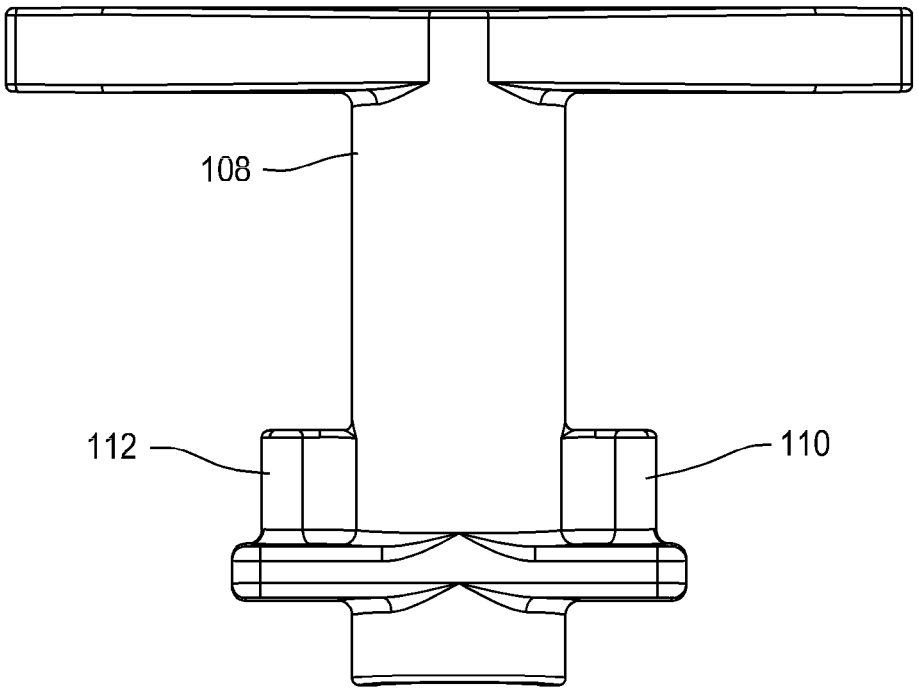

Fig. 9

DEPTH ADJUSTMENT FOR CONTROLLING PLANTING DEPTH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to agricultural seed planting implements and to the furrow opening assemblies thereon, and more particularly to the apparatus for adjusting the depth of the furrow opened by the furrow opening assembly.

2. Description of the Related Art

Farmers utilize a wide variety of seed planting implements, including seed drills and planters. In a known type of planting implement, seed planting or row units are attached to a toolbar extending transverse to the direction of planting. The toolbar is coupled to a tractor or other work vehicle suitable for pulling the planting implement along a field that is to be seeded to a crop. Each planting unit includes a ground penetrating assembly, often including one or more discs, for opening a seed trench or furrow in the ground as the planting implement is pulled across a field. Components of the ground penetrating assembly shape the bottom and sides of the seed trench, and a seed metering device provides individual seeds at a controlled rate for deposit in the seed trench. Furrow closing components of each row unit close the seed trench in a controlled manner.

It is a desirable and perhaps even primary agronomic principle that seeds should be planted at precisely controlled and consistent depths. Since a single planting implement may be used to plant several different types of crops and/or the same crop in different planting locations under different planting and growing conditions, it is necessary that the planting depth is adjustable so that the seeds are placed at a depth that has been determined to be the best for seed germination and plant growth of the particular crop under the existing and anticipated conditions.

To control planting depth, it is known to provide gauge wheels that travel on the surface of the field to control the depth to which the ground penetrating assembly can run, the positions of the gauge wheels being adjustable so that the depth of the seed trench can be controlled within fractions of an inch. Adjustment linkages are provided for changing the relative positioning of the gauge wheels with respect to the ground penetrating assembly. It is known to move the adjustment linkage by a handle connected thereto, the handle engaging a register having multiple positions for securing the handle to maintain the position to which the handle is adjusted

As growers have gained greater understanding about seed germination and plant growth, and as soil preparation procedures have changed and improved, crop growers have demanded more precise control over seed placement both in spacing between seeds and in the depth at which the seeds are placed below the soil surface. Accordingly, there is both a demand and a need for even more precise control over the depth of the seed trench that is formed during planting operations.

What is needed in the art is a depth adjustment control for a planting implement that provides greater control over the depth to which ground penetrating components can run during a planting operation.

SUMMARY OF THE INVENTION

The present invention provides a seed planting implement with finer depth control for ground penetrating components of the implement by providing a depth adjuster assembly with a depth adjustment register and a handle engaging the register in multiple positions for each register location.

In one form thereof, the invention is directed to an agricultural seed planting implement with a ground penetrating assembly and a depth control assembly associated with the ground penetrating assembly and having adjustable positions for changing a depth to which the ground penetrating assembly can operate. The depth control assembly includes a register defining a securing location, and a handle having a first handle orientation in which the handle engages the securing location to establish a first depth for the ground penetrating assembly and a second handle orientation in which the handle engages the securing location to establish a second depth for the ground penetrating assembly.

In another form, the invention is an agricultural seed planting implement with a ground penetrating assembly, an adjustable gauge wheel supporting the ground penetrating assembly at controlled penetration depths and a depth control linkage arm adjustably positioning the gauge wheel. A handle is connected to the depth control linkage arm for axially positioning the depth control linkage arm. The handle is rotatable about a longitudinal axis thereof. A depth adjustment register includes a pair of notches engaged by the handle in a first rotational orientation of the handle for establishing a first depth for the ground penetrating assembly and in a second rotational orientation of the handle for establishing a second depth for the ground penetrating assembly.

In a further form thereof, the invention is an agricultural seed planting implement with a ground penetrating assembly and a depth control assembly adjusting the depth to which the ground penetrating assembly operates. The depth control assembly includes an adjustable arm and a register having pairs of notches for securing the position of the adjustable arm. A handle on the arm is rotatable between first and second orientations for selectively engaging each pair of notches in either the first orientation or the second orientation and defining different depths for the ground penetrating assembly.

An advantage of the depth adjustment for ground penetrating equipment disclosed herein is that the penetration depth for seed planting equipment can be controlled easily and accurately.

Another advantage of the depth adjustment for ground penetrating equipment disclosed herein is that more options are provided for planting depth control.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is a perspective view of an agricultural seed planting implement;

FIG. **2** is a perspective view of one of the seed planting units of the seed planting implement;

FIG. **3** is a side view of the seed planting unit;

FIG. **4** is another perspective view of the seed planting unit, showing the unit from an angle different from the angle shown in the perspective view of FIG. **2**;

FIG. **5** is a fragmentary side view of the seed planting unit illustrating inner components used for depth adjustment;

FIG. **6** is an enlarged fragmentary view of the depth adjustment register for the seed planting unit;

FIG. **7** is an enlarged perspective view of the depth adjuster linkage assembly of the seed planting unit;

FIG. **8** is a top view of the handle of the depth control assembly in the seed planting unit; and

FIG. **9** is an elevational view of the handle.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates one embodiment of the invention and such exemplification is not to be construed as limiting the scope of the invention in any manner.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings more specifically and to FIG. **1** in particular, a seed planting implement **10** is shown. Seed planting implement **10** has a frame that includes a tow bar assembly **12** having a tow bar **14** and a connection assembly **16** at the longitudinally forward end thereof configured for mating with a corresponding hitch of a tractor or other work vehicle (not shown) for pulling seed planting implement **10** through a field. A laterally extending toolbar **18** is generally transverse to tow bar **14** and thereby generally transverse to the direction implement **10** is towed during planting operations. A plurality of seed planting units (or row units) **20** are connected to toolbar **18** in a side by side relationship, each of the seed planting units (row units) being substantially identical to the others. In the exemplary embodiment shown, seed planting implement **10** includes sixteen seed planting units **20**, only some of which are identified with reference numbers; however, it should be understood that more or fewer seed planting units can be provided on a particular seed planting implement.

Referring now primarily to FIG. **2** through FIG. **5**, each seed planting unit **20** includes a frame **22** that is connected to toolbar **18** by upper arms **24** and lower arms **26**, each arm **24**, **26** being connected to frame **22** and to toolbar **18**. Accordingly, each seed planting unit **20** extends rearward from toolbar **18** to plant a row of seeds as seed planting implement **10** is towed across a field. The individual planting units **20** are spaced along toolbar **18** to provide planted seed rows of a desired spacing. During a planting operation, forward movement of seed planting implement **10** causes each seed planting unit **20** to form a seed trench, deposit equally spaced seeds in the seed trench and close the seed trench over the deposited seeds.

Each seed planting unit **20** includes a ground penetrating or seed trench opening assembly **30** (FIG. **3**) having a pair of forwardly and downwardly angled opening discs **32** that converge forwardly and downwardly to open a furrow or seed trench as seed planting implement **10** moves forward. A seed metering system **34** receives seeds from a seed hopper **36** and provides individual seeds at a controlled rate to a seed tube **38** for deposit in the bottom of the seed trench formed. A vacuum system **40** (FIG. **1**), which includes a fan **42** and air lines **44**, provides vacuum to seed metering system **34** for the operation of the seed metering system in supplying seeds to seed tube **38**.

A seed trench closing mechanism **50** (FIG. **1**) at the trailing end of each seed planting unit **20** closes the seed trench after the seeds have been deposited in the seed trench. Seed trench closing mechanism **50** includes a pair of pinch wheels **52** (FIG. **2**) that operate on opposite sides of the seed trench to move soil back into the seed trench and over the seeds deposited in the bottom of the seed trench. A trailing press wheel **54** (FIG. **1**) travels along the top of the closed seed trench and firms the soil replaced in the seed trench.

The depth to which opening discs **32** are allowed to penetrate the ground is controlled by a depth control assembly **60** (FIG. **5**) that includes a pair of gauge wheels **62**, gauge wheel arms **64** and a depth adjuster and linkage assembly **80**. One of the gauge wheels **62** is provided adjacent each opening disc **32**. Each gauge wheel **62** is rotatably mounted on one of the gauge wheel arms **64** that are pivotally connected at a pivotal attachment **66** to seed planting unit frame **22**. Each gauge wheel arm **64** has a wheel retention segment **68** extending generally rearward from pivotal attachment **66** and a control segment **70** extending generally upward from pivotal attachment **66**. Pivoting gauge wheel arm **64** about pivotal attachment **66** to frame **22** changes the relative height position of gauge wheel **62**.

A pivoted position to which each gauge wheel arm **64** is placed is controlled by depth adjuster and linkage assembly **80** having a control assembly **82**, a depth control linkage arm **84** and a wobble bracket **86**. Control assembly **82** adjusts an axial position for linkage arm **84** and thereby the position of wobble bracket **86**, with wobble bracket **86** engaging control segments **70** of gauge wheel arms **64**. Raising gauge wheels **62** allows opening discs **32** to penetrate deeper into the ground, and lowering gauge wheels **62** limits the depth to which discs **32** can penetrate into the ground.

Referring now primarily to FIG. **5** through FIG. **7**, control assembly **82** includes a pivot arm **90** of general V-shape, with a pivotal connection **92** at the base thereof to seed planting unit frame **22**. An inner arm **94** of pivot arm **90** has a pivotal connection **96** to depth control linkage arm **84**. An outer arm **98** of pivot arm **90** extends through a depth adjustment register **100**. Depth adjustment register **100** defines a slot **102** with a first row of notches **104** along one side of slot **102** and a second row of notches **106** along an opposite side of slot **102**. Opposed pairs of notches including one of the notches **104** and one of the notches **106** define securing locations for securing the position of pivot arm **90** after adjustment thereof.

A handle **108** is provided on the distal end of outer arm **98** and includes laterally projecting position holding pegs **110**, **112** for engaging notches **104**, **106** of register **100**. The pairs of notches including one of the notches **104** and one of the notches **106** secure the position of pivot arm **90** by receiving and engaging pegs **110**, **112**. Handle **108** is mounted on a spring **120**, and can be depressed relative to outer arm **98** such that pegs **110**, **112** disengage notches **104**, **106** by sliding inwardly through the notches so that handle **108** can be moved fore and aft in slot **102** to align pegs **110**, **112** with different pairs of notches **104**, **106**. As handle **108** rebounds outwardly, pegs **110**, **112** slide into the pair of notches **104**, **106** with which the pegs are aligned. Movement of handle **108** fore and aft pivots pivot arm **90** about its pivotal connection **92**, and thereby extends or withdraws depth control linkage arm **84**, to alter the position of wobble bracket **86**, which in turn controls the positions of control segments **70** and thereby the allowable height of gauge wheels **62**.

With reference now particularly to FIG. **8**, it can be seen that outer arm **98** defines a longitudinal axis **114** and pegs **110**, **112** define longitudinal axes **116**, **118** respectively. Axes **116**, **118** are not aligned with axis **114**; that is, a plane defined by axes **116**, **118** does not include axis **114**. Handle **108** is rotatable about longitudinal axis **114** so that pegs **110**, **112** thereof can be selectively and alternately engaged with notches **104** and **106**. That is, handle **108** can be rotated to a first orientation in which peg **110** engages a notch **104** while peg **112** engages a notch **106**, or a second orientation in which peg **110** engages a notch **106** while peg **112** engages a notch **104**. Rotating handle **108** by 180° from the first handle orientation to the second handle orientation changes an extended position of depth control linkage arm **84** for each pair of notches **104**, **106** engaged by pegs **110**, **112**. For example, with handle **108** in the position shown in FIG. **6**, a position in which pegs **110**

and **112** are machine forward relative to axis **114**, peg **110** engages the aft most notch **104** and peg **112** engages the aft most notch **106**. Depth control linkage arm **84** is in a first extended position, with gauge wheels **62** positioned thereby at a first adjusted position and opening discs **32** placed at a first depth. If handle **108** is rotated such that pegs **110** and **112** are machine rearward relative to axis **114**, peg **110** will engage the aft most notch **106**, and peg **112** will engage the aft most notch **104**, control linkage arm **84** will be in a different extended position, with gauge wheels **62** positioned thereby in a second adjusted position and opening discs **32** placed at a second depth. Accordingly, for each pair of notches **104**, **106** there are two possible extended positions for depth control linkage arm **84**, depending on which of pegs **110**, **112** is engaged with a notch in the first row of notches **104** and which is engaged with a notch in the second row of notches **106**, each different extended position for depth control linkage arm **84** resulting in a different depth for opening discs **32**. Depth control assembly **60** thereby provides twice as many adjusted positions as there are pairs of notches **104**, **106**. Stated yet another way, for each pair of notches **104**, **106** there exists two positions for handle **108** and therefore two different relative extended positions for depth control linkage arm **84**, resulting in two different settings for gauge wheels **62** and thereby two different depth settings for opening discs **32**. A single pair of notches can establish two depth settings, two pairs of notches can establish four depth settings, three pairs of notches can establish six depth settings, etc.

While this invention has been described with respect to at least one embodiment, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

What is claimed is:

1. An agricultural seed planting implement, comprising:

a ground penetrating assembly;

an adjustable gauge wheel supporting said ground penetrating assembly at controlled penetration depths;

a depth control linkage arm adjustably positioning said gauge wheel;

a handle connected to said depth control linkage arm for axially positioning said depth control linkage arm, said handle being rotatable about a longitudinal axis thereof; and

a depth adjustment register including a pair of notches, each notch of said pair of notches engaged by said handle in a first rotational orientation of said handle for establishing a first depth for said ground penetrating assembly and in a second rotational orientation of said handle for establishing a second depth for said ground penetrating assembly.

2. The agricultural seed planting implement of claim **1**, said depth adjustment register including a second pair of notches, each notch of said second pair of notches engaged by said handle in said first rotational orientation of said handle for establishing a third depth for said ground penetrating assembly and in said second rotational orientation of said handle for establishing a fourth depth for said ground penetrating assembly.

3. The agricultural seed planting implement of claim **2**, said depth adjustment register including a third pair of notches, each notch of said third pair of notches engaged by said handle in said first orientation of said handle for establishing a fifth depth for said ground penetrating assembly and in said second rotational orientation of said handle for establishing a sixth depth for said ground penetrating assembly.

4. The agricultural seed planting implement of claim **3**, said register defining a slot with a first row of notches on one side of said slot and a second row of notches on an opposite side of said slot.

5. The agricultural seed planting implement of claim **4**, said handle including first and second pegs selectively engaged with said notches, said first peg engaged with notches of said first row of notches and said second peg engaged with notches of said second row of notches in said first orientation of said handle; and said first peg engaged with notches of said second row of notches and said second peg engaged with notches of said first row of notches in said second orientation of said handle.

6. The agricultural seed planting implement of claim **1**, said register defining a slot with a first notch of said pair of notches on one side of said slot and a second notch of said pair of notches on an opposite side of said slot.

7. The agricultural seed planting implement of claim **6**, said handle including first and second pegs, and said handle being rotatable between a first position in which said first peg is engaged in said first notch and said second peg is engaged in said second notch and a second position in which said first peg is engaged in said second notch and said second peg is engaged in said first notch.

8. An agricultural seed planting implement, comprising:

a ground penetrating assembly;

a depth control assembly adjusting the depth to which said ground penetrating assembly operates;

said depth control assembly including an adjustable arm and a register having pairs of notches for securing the position of said adjustable arm; and

a handle on said arm, said handle being rotatable between first and second orientations for selectively engaging each pair of notches in either said first orientation or said second orientation and establishing different depths for said ground penetrating assembly in each orientation for each pair of notches.

9. The agricultural seed planting implement of claim **8**, said handle having first and second pegs having longitudinal axes defining a plane and said handle having a longitudinal axis outside of said plane.

10. The agricultural seed planting implement of claim **9**, said pegs being in a machine forward position relative to said axis of said handle in one of said first and second orientations and in a machine rearward position relative to said axis of said handle in the other of said first and second orientations.

* * * * *